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ABSTRACT

An overview of America's energy situation is presented with emphasis on recent progress, the risk of depending upon foreign oil, and policy choices. Section one reviews the energy problems of the 1970s, issues of the 1980s, concerns for the future, and choices that if made today could alleviate future problems. Section two examines past problems, new progress, and the future outlook for oil and natural gas. Section three presents similar information for coal, synthetic fuels, nuclear power, and renewable energy sources. Energy conservation is discussed in section four in terms of previous trends, the gross national product, efficiency, transportation, residential and commercial use, industry, fuel switching, and future outlook. The next section addresses the risk of international oil supply emergencies. A discussion of policy choices for the future related to natural gas price controls, federal land use restrictions, environmental laws and regulations, and nuclear energy comprises the concluding section. (DC)

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Energy in America
Progress and Potential

SE 036 092

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Cover: *A surface geologic map shows producing oil fields—"Lost Soldier and "Wertz" domes—on the rim of the Green River Basin in south-central Wyoming. Geologists can use such maps to identify likely drilling prospects in the search for supplies of oil and natural gas.*

CORRECTION

Energy in America: Progress and Potential
American Petroleum Institute 1981

Page 19, left column, first full paragraph from the bottom of the page: The sentence, "Nuclear power has replaced oil as the second leading source, after coal, for the generation of electricity," is incorrect. In fact, while nuclear power has moved ahead of oil as a source for the generation of electricity, it ranks fourth as a source after coal, natural gas and hydropower.

According to the U.S. Department of Energy, the 1980 net electricity production by primary energy sources are, in million kilowatt-hours:

Coal	1,161,562
Natural Gas	346,240
Hydropower	276,021
Nuclear	251,116
Oil	245,994

Table of Contents

Progress and Potential	2
Oil and Natural Gas	6
Other Energy Sources	14
Energy Conservation	21
The Risk of International Emergency	28
Policy Choices for the Future	34
Conclusion	39

American Petroleum Institute 1981
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In 1980, the American Petroleum Institute published *Two Energy Futures: A National Choice for the 80s.* A second edition with updated figures was issued in 1981.

Two Energy Futures relates the U.S. energy history of the 1970s and the energy prospects for the 1980s. It concludes that the nation could reduce its dependence on imported oil by one-half during the decade of the 1980s, if the right steps are taken.

Two Energy Futures notes that reaching this goal requires neither miracle solutions nor great self-sacrifice. Nor does it mean sacrificing environmental or other important national goals. Rather, it depends on reasonable U.S. policy choices that can help boost conservation and domestic production of energy.

America is now moving toward the goal of greater energy security. U.S. oil imports have declined dramatically.

Energy in America examines America's recent energy progress. It also points out the continuing risk of oil supply disruption that underscores the need for further progress. And it notes additional policy choices available to the nation—choices that could assure such progress toward a more secure energy future.

Progress and Potential

The decade of the 1980s has begun with striking confirmation that America has a choice of energy futures. There are now signs that the nation is choosing the brighter alternative. And the issue for today and tomorrow is whether this progress will continue. Consider the past, the present and the future.

The Past

Only a few years ago, America's oil import problems led many people to conclude that the country's energy situation was desperate, and that little or nothing could be done about it. Among the discouraging developments of the 1970s:

- Domestic oil and natural gas production began to fall in the early 1970s and generally declined through most of the decade.
- U.S. energy consumption climbed steadily in the 1970s, except for a brief decline following the Arab oil embargo in 1973-74.
- The nation's dependence on uncertain foreign oil supplies rose rapidly—from 3.4 million barrels a day in 1970 to 8.4 million barrels a day in 1979, nearly *half* of U.S. oil consumption.
- The U.S. oil import bill climbed from $3 billion in 1970 to $60 billion in 1979.
- The sources of U.S. oil imports were increasingly concentrated in the volatile Persian Gulf area.
- The Arab oil embargo of 1973-74 and the Iranian revolution of 1979 brought sharply higher world oil prices and interruptions in U.S. oil imports which triggered gasoline lines in many parts of the country—and unexpected new fears and difficulties for Americans.
- Government groped for solutions—but federal regulations and controls generally made problems worse.

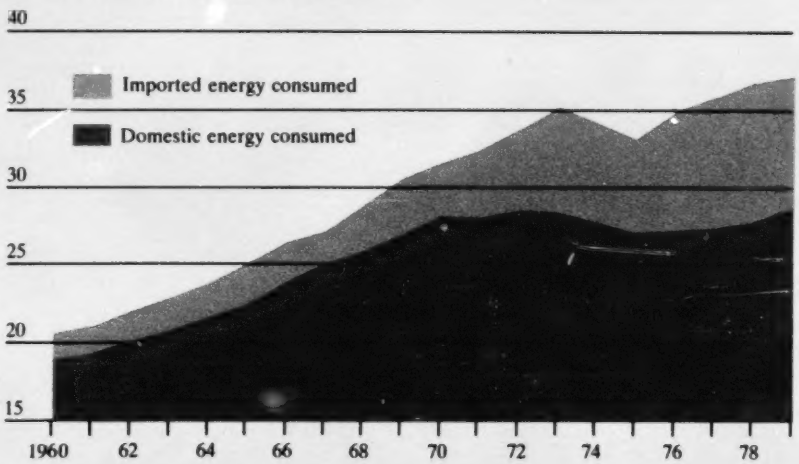
By the end of the 1970s, the energy crisis appeared to many people to be a permanent feature of American life.

The Present

The energy problems of the 1970s have not disappeared. The United States still imports a substantial amount of the oil it uses—almost 40 percent of it from troubled and politically unstable regions of the world. At any time, Americans could suddenly find themselves paying even higher prices for oil imports or find vital oil supplies cut off.

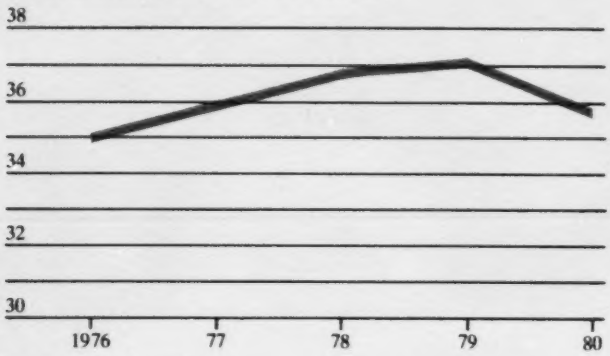
But the United States is discovering that this level of dependence on imports—although it remains a danger today—need *not* be permanent. There is evidence that America is turning the corner—away from the energy road of the 1970s and toward a new course for the 1980s.

U.S. Energy Consumption
(million barrels per day crude oil equivalent)



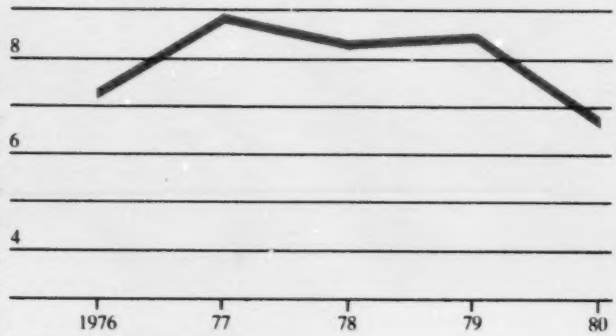
Source: Department of Energy

U.S. Energy Consumption
(million barrels per day crude oil equivalent)



Source: Department of Energy

U.S. Oil Imports
(million barrels per day)



Source: Department of Energy

The nation has seized several opportunities to improve its energy outlook. Energy conservation is returning big dividends. Investment in new domestic energy production is beginning to pay off.

Common sense solutions. Rising world oil prices are playing a large part in our energy decisions, with Americans responding to world oil price hikes by conserving more energy than analysts had thought likely.

And there is growing recognition that there are attainable, practical, environmentally sound solutions to America's energy problems—solutions that do not depend on miracle cures or great self-sacrifice, but on simple *common sense*.

One such measure was the decontrol of crude oil prices. In June 1979, the Carter administration began the gradual removal of price controls on domestic crude oil—controls that had disrupted the normal functioning of the market for nearly 10 years. In January 1981, the Reagan administration accelerated and completed the decontrol process.

Analysts agree that oil decontrol is a major cause of solid progress in current U.S. energy conservation and production. It is also providing incentive for increased exploration for conventional fuels and for intensified development of new energy sources for future years.

Some 1980 statistics:

- *Total U.S. energy production—up 1.3 percent,* from the equivalent of 30.2 million barrels of oil a day in 1979 to the equivalent of 30.6 million barrels a day in 1980.
- *Total U.S. energy use—down 3.8 percent,* from the equivalent of 37.3 million barrels of oil a day in 1979 to the equivalent of 35.9 million barrels a day in 1980.

With these developments have come striking changes in Americans' use of oil, especially foreign oil. During 1980:

- *Total U.S. oil consumption dropped by more than 8 percent,* from 18.5 million barrels a day in 1979 to 17 million barrels a day in 1980 —the largest one-year drop ever.
- *U.S. oil imports dropped by more than 19 percent,* from 8.4 million barrels a day in 1979 to 6.8 million barrels a day in 1980—again, the largest one-year drop ever.

These trends continued in the first half of 1981. U.S. oil consumption fell to 16.1 million barrels a day—down almost 7 percent from the first half of 1980. Oil imports dropped to 5.9 million barrels a day—down a further 20 percent

from the first half of 1980.

With these reductions, oil imports from OPEC nations declined from 5.6 million barrels a day in 1979 to 4.2 million barrels a day in 1980.

The Future

Despite today's encouraging progress, the United States must assume that it will face interruptions of foreign oil supplies and possible sudden price increases in the future.

More than one-third of the nation's oil—down from nearly one-half—still comes from other countries.

So, it is important that America continue to move away from the risks of unreliable oil imports and toward the greater security of increased self-sufficiency.

Fortunately, the United States has enough resources so that with common sense energy policies over the decade of the 1980s, it could:

- Slow or possibly halt the 1970s decline in oil and gas production.
- Double our use of coal in an environmentally sound manner.
- Triple the contribution of nuclear power—by completing plants that already have government permits or are on order.
- Get important new production from synthetic fuels and renewable sources such as solar energy.
- Continue to conserve energy and use it more efficiently.

The result: *Given recent progress, it is now more evident than ever that America could cut its oil imports in half over the decade of the 1980s.* And we can do so without sacrificing environmental or other important national goals, and still meet the increased total energy needs of a growing economy.

As *Two Energy Futures* emphasizes, this is not a forecast of what *will* happen by 1990. It is a realistic description of what *could* happen, with the contribution from any one source possibly more or less than that described above.

Although oil imports, like other imported goods, are not necessarily bad for the nation—and should not be reduced without regard for cost—Americans have learned that unreliable supplies of foreign oil pose a continuing threat.

The important point is that today's accomplishments can become long-term trends. America *can* regain much of the energy self-sufficiency and security that it enjoyed in the past. It can also build up its Strategic Petroleum Reserve and assure enough flexibility to handle possible emergencies. The energy risks that the nation will face through much of this decade have been reduced and can be further reduced each year.

The benefits for America. With continued energy progress, all Americans would enjoy the benefits of:

- More certain energy supplies for factories, homes and cars.
- More secure personal lifestyles.
- More stable future energy prices.

For the nation, further progress could mean:

- A stronger economy—a sounder dollar, an improved balance of payments and lower inflation than otherwise.
- A freer hand in foreign affairs—and greater independence from the threat of energy blackmail or terrorism overseas.

The Choices Today

Will the nation choose to take the steps needed to assure continued progress and to accelerate that progress in the years ahead?

Further common sense choices are needed now.

Some policies, often unintentionally, discourage energy conservation or energy production—or both.

What is needed:

- Realistic, competitive prices for U.S. natural gas.

- A constructive policy for the exploration and development of energy on government lands.
- Policies that allow us to meet both our environmental goals and our energy needs.
- A predictable, steady course for nuclear power.

Americans continue to have a choice. We can choose policies that move us toward these goals. We can transform today's good developments into the long-term trends of the 1980s.

If we make these choices, the nation will continue to turn the corner—toward a better, more secure energy future for all Americans.

The search for new supplies of U.S. energy often takes geologists into rough, remote areas.

Oil and Natural Gas

The outlook for domestic oil has improved substantially in recent years—a striking sign of U.S. energy progress. The outlook for natural gas is less certain, due to continued regulation, but could be much enhanced with government policies that encourage its reasonable development and use.

Past Problems

In the 1970s, production of oil and natural gas in the United States—and the discovery of new reserves—began to slack off, although energy consumption was increasing. As time went on, analysts feared that strong downward trends would prove irreversible. By the end of 1979, these were the discouraging facts:

- *Oil production*—down 11 percent,* from a 1970 peak of 3.5 billion barrels to 3.1 billion in 1979.
- *Natural gas production—down 10 percent,* from a 1973 peak of 22.6 trillion cubic feet to 20.5 trillion in 1979.
- *Proved oil and natural gas reserves**— down 32 percent,* from a 1970 peak of 96.2 billion barrels of crude oil equivalent to 65.8 billion in 1979.

Thus, at the end of the decade, the outlook for U.S. oil and natural gas seemed to be growing steadily worse. Many people were convinced that the nation would need to import ever larger amounts of oil to fill the gap between rising domestic energy consumption and declining production.

New Progress

But recent dramatic progress suggests that the downward oil and natural gas trends of the 1970s could be substantially slowed or even halted, and that improvements in these trends could help reduce oil imports.

Some slight signs of progress occurred during the latter 1970s. Although artificially low U.S. government price controls generally ignored the new reality of high-cost energy, some modest price increases in domestic oil and natural gas were permitted. These enabled U.S. producers to make moderate gains in their search for new supplies, for example. But, overall, during the latter 1970s the outlook for domestic oil and natural gas grew dimmer.

Much more dramatic recent progress has been spurred by the removal of price controls on oil. The phasing out of federal price and allocation controls on crude oil and regulated petroleum products was begun by President Carter in 1979 and completed by President Reagan in January 1981.

These actions gave fresh impetus to the search for new supplies of oil. And, because drilling for oil sometimes leads to the discovery of natural gas, decontrol of oil prices has indirectly improved the outlook for gas. (Still, in mid-1981 most natural gas remained under federal controls, and its outlook continued to be uncertain.)

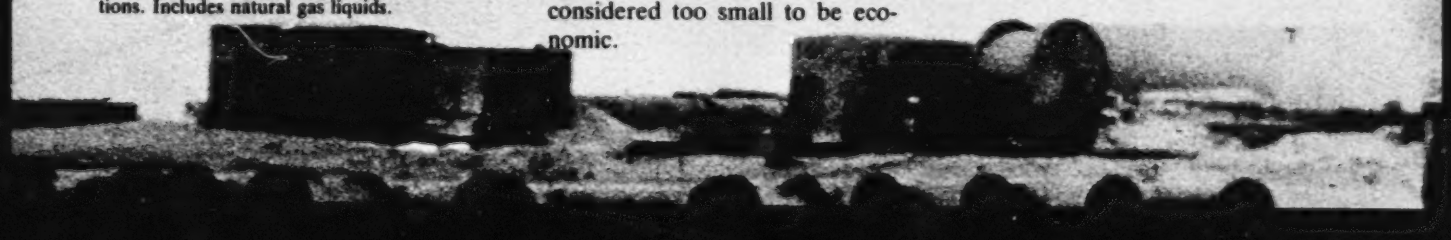
Deregulation of U.S. oil is helping America's 12,000 large and small petroleum producers to:

- Speed up the search for new fields in frontier areas.
- Re-explore older producing areas for supplies that may have been missed in earlier drilling.
- Drill deeper for oil that could not be produced economically under federally controlled prices.
- Produce oil from reservoirs once considered too small to be economic.

Oil wells on Alaska's North Slope must be especially engineered to withstand sub-zero Arctic temperatures.

*Excludes natural gas liquids.

**Proved reserves are estimated quantities of oil and gas in known reservoirs economically recoverable under current operating conditions. Includes natural gas liquids.



- Invest more heavily in advanced technology to increase recovery from existing fields.
- Keep many fields producing longer.

The Signs of Change

Already, there are striking signs of change, especially in regard to oil, and hints of progress yet to come. The 1980 statistics in brief, compared with 1979:

- *Active seismic crews*—up 33 percent.*
- *Drilling rigs at work—up 34 percent.*
- *Wells drilled—up 22 percent.*
- *Oil production—up 0.5 percent.*
- *Proved oil and natural gas reserves—decline slowed.*

The disappointing trends of the 1970s cannot be reversed overnight. Enormous industry effort is required even for small gains. And, for natural gas, because of continued regulation, the outlook remains clouded. But for the first time in almost a decade, the United States has made promising headway in easing its petroleum supply problems.

Encouraging developments have come in each of several areas: *exploration, drilling, production, proved reserves, and capital and exploration spending.*

Exploration: Intensified Efforts

Seismic activity. U.S. seismic activity, a principal indicator of the pace of exploration, is surging toward the record levels of the 1950s.

The average number of active seismic crews scientifically testing underground rock strata for petroleum potential:

- *Grew steadily* in 1977, 1978 and [illegible] by roughly 15 percent over each preceding year, reaching an average of 400 crews per month in 1979.
- *Escalated sharply* in 1980 by 33 percent over 1979, to 530 per month. The number of seismic crews active in the first half of 1981 averaged 634, up from 491 in the same period in 1980—a 30 percent increase. (The record high annual average was 663 in 1952.)

Growth in seismic activity is followed by a proportionate increase in the number of exploratory wells drilled. The rate of drilling, in turn, influences the rate of discovery and production. And, the more exploration for oil and natural gas, the more that is likely to be found.

Drilling: Record Highs

In 1980, petroleum drilling reached record levels in several areas and showed impressive progress in others.

Drilling permits. Major oil and natural gas producing states granted many more drilling permits in 1980 than in 1979. For example, these states reported sharp increases in permits in 1980, compared with 1979:

- *California—up 36 percent.*
- *Louisiana—up 41 percent.*
- *Oklahoma—up 57 percent.*
- *Texas—up 35 percent.*

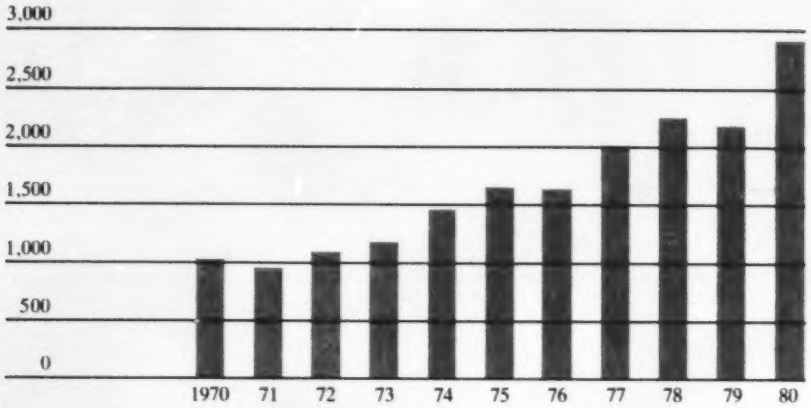
Increases in drilling permits indicate that market pricing for [illegible] encouraged producing companies to undertake the risks of costly drilling for oil and gas. [illegible]ording to the *Joint Association Survey on Drilling Costs,** the average well cost $331,[illegible]7 in 1979, the last year for which data are available.)

Rigs at work. According to the Hughes Tool Company, the 1980 av-

[illegible] data to help producers [illegible].

*The survey is issued by the American Petroleum Institute, the Independent Petroleum Association of America and the Mid-Continent Oil & Gas Association.

Rotary Rigs at Work
(annual average)



Source: Hughes Tool Co.

erage of 2,910 rotary drilling rigs* at work was the highest in U.S. history—up by more than a third over the previous year's total.

Record increases continued in 1981. The number of rotary rigs at work reached a new record high. By the end of June 1981, the weekly rig count had climbed to more than 4,000 for the first time ever.

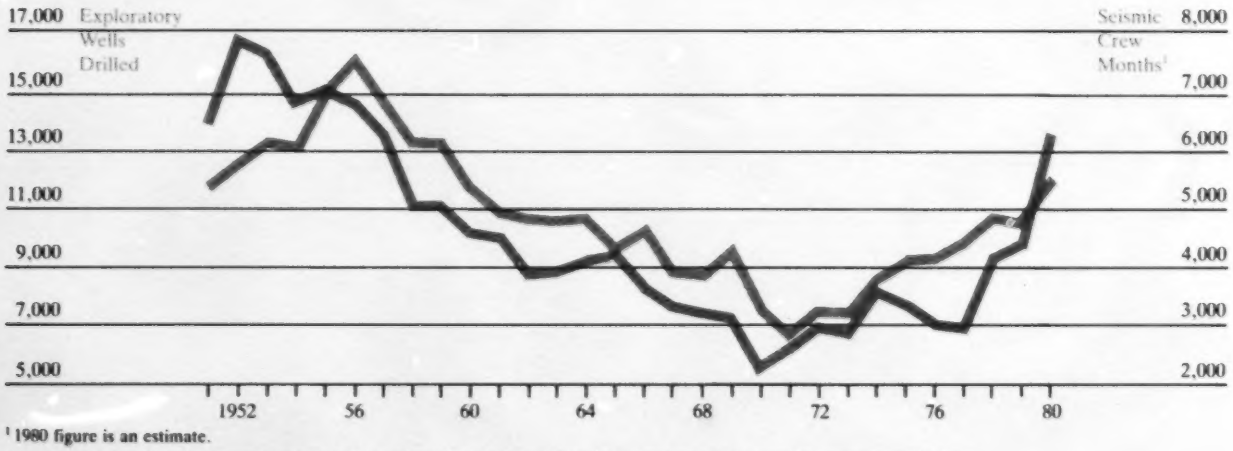
Wells drilled. The number of wells drilled in the United States accelerated sharply in 1980 compared with 1979. Spurred by price decontrol, well completions:

- Climbed by 22 percent overall from 51,263 in 1979 to 62,462 in 1980—the largest increase since World War II.
- Broke the 1956 record by more than 4,300 wells.

Oil wells accounted for more than two-thirds of the 1980 drilling increase. Drilling for natural gas grew at a more modest rate, in part be-

*A rotary rig, the principal drilling rig, uses a rotating bit for boring holes through rock.

Exploration: Seismic Activity and Wells Drilled



[1] 1980 figure is an estimate.

Sources: Society of Exploration Geophysicists, American Association of Petroleum Geologists and American Petroleum Institute

A "jack-up" rig drills for oil in the Gulf of Mexico off the Texas-Louisiana coast. The structure is towed to the drill site and then "jacked-up" on steel legs to a safe height above storm-driven waves.

cause price-controlled natural gas sells at relatively lower prices than oil. (In contrast, drilling for *decontrolled* "deep gas"—gas from wells deeper than 15,000 feet—has increased sharply. The average number of deep gas wells completed in 1970 through 1977 was 166 yearly; the average for 1978 through 1980 jumped to 298 per year. The 1980 total of 322 deep gas wells drilled set a new record.)

Drilling for oil continued strongly in 1981. The first six months of the year brought a 40 percent jump in exploratory oil well completions and a 41 percent increase in development oil well completions over the first six months of 1980.*

Exploratory natural gas well completions increased 19 percent in the same period, and the number of development gas wells completed increased 4 percent.

Results. No one can predict the amount of oil and natural gas that U.S. producers may be able to locate. Most exploratory wells drilled do not strike oil or natural gas in marketable quantities. For example, about 500 "dry holes" preceded the first commercial discovery made in 1974 in the Western Overthrust Belt of Utah and Wyoming—an area in which exploration is now booming.

Nevertheless, the accelerated pace of drilling has enhanced U.S. chances of finding vital new supplies of petroleum.

Production:
Encouraging Progress

It takes time for increased drilling to result in increased production. But after years of discouraging decline—halted only briefly by the opening of the Alaska pipeline in the late 1970s—U.S. crude oil production posted an overall *gain* in 1980 of more than one-half of 1 percent, from 8.552 million barrels a day in 1979 to 8.597 million in 1980. It is not the size of the gain that is significant, but the halt, at least temporarily, of the decline. Natural gas production fell slightly, from 20.47 trillion cubic feet in 1979 to 20.09 trillion in 1980.

Oil production. Oil production increased in 1980 partly because more oil flowed from Alaska's North Slope. The flow was stepped up because:

- An additive helped reduce friction so that oil could flow more quickly through the pipeline.
- Pumping facilities were expanded, increasing production capacity.

Equally important, in the states outside Alaska, the rate of decline in production slowed in 1980. During the 1970s, production from the "lower 48" states dropped by an average of more than 300,000 barrels a day each year. That rate was cut by two-thirds to a decline of 100,000 barrels a day in 1980 as a result of enhanced recovery* of oil in producing fields and increased drilling. For the first six months of 1981, the average decline was only about 50,000 barrels a day.

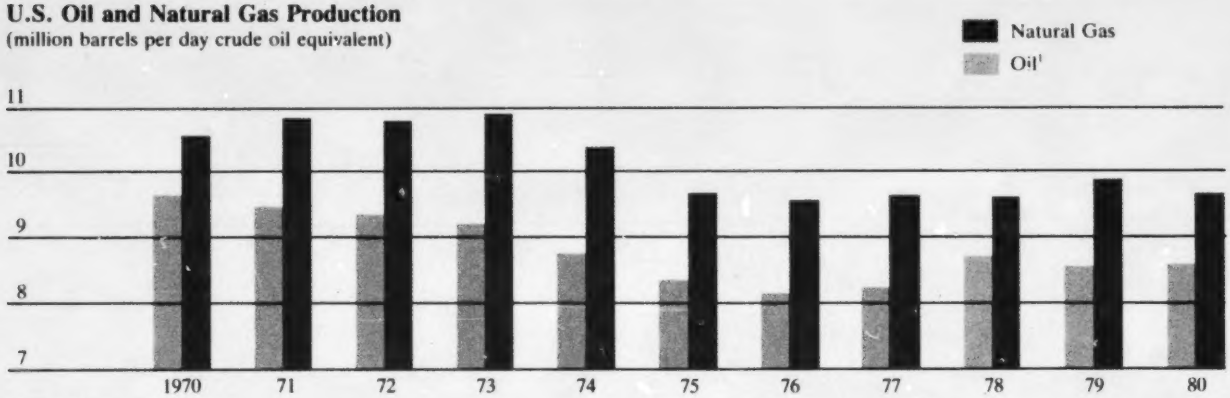
Halting—or even further slowing—the decline in oil production in the states outside Alaska will be an extremely difficult task. Obviously, it ultimately will be impossible. But recent production results represent important progress.

Natural gas. Preliminary U.S. Department of Energy figures show that gas production was fairly stable in 1980, falling by less than 2 percent from 1979 levels and remaining

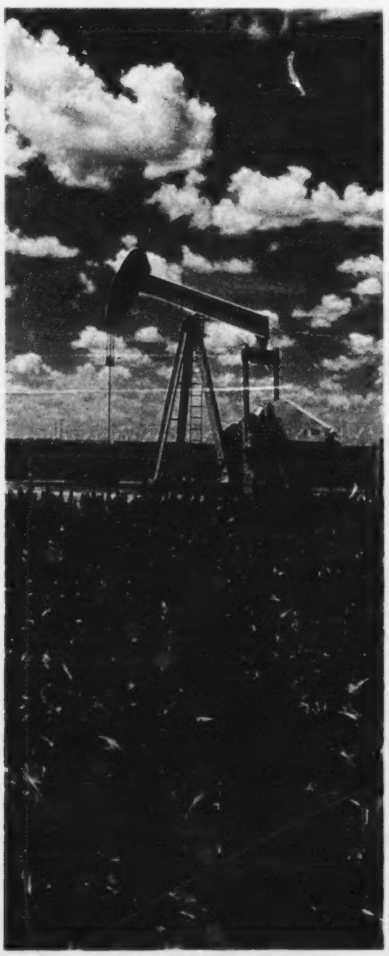
*An exploratory well is drilled to extend the limits of a known reservoir, to find a new reservoir in a producing field or to seek oil or gas in an unproved area. A development well is one drilled in an already productive area and completed for production.

*Enhanced recovery is the injection of steam, gases or chemicals into underground reservoirs to thin petroleum or otherwise cause it to flow toward producing wells.

U.S. Oil and Natural Gas Production
(million barrels per day crude oil equivalent)



[1] Includes lease condensate.
Sources. U.S. Bureau of Mines and Department of Energy



A pumping unit in a Kansas sorghum field forces water and chemicals into the ground to push out hard-to-recover oil.

The Western Overthrust Belt—a series of complex geologic structures extending from Canada into Mexico—contains areas rich in oil and natural gas. Major producing areas are Wyoming and Utah.

at about the level of the late 1970s. As stated, drilling and production are still held back by federal price controls on most categories of natural gas.

A 4,800-mile pipeline system is being planned to deliver natural gas from the Alaska North Slope to consumers in other states. The gas could begin flowing in the late 1980s. (Portions of the system are expected to begin delivering Canadian gas to the United States in the early 1980s.)

New production areas. New production of both oil and gas is coming from many regions, including some that were barely considered promising 10 years ago.

- New offshore fields in the Gulf of Mexico and off the California coast.
- The Western Overthrust Belt in the Rocky Mountain states.
- Gas wells—some almost six miles deep—in Louisiana, the Anadarko Basin of Texas and Oklahoma, and the Williston Basin of North Dakota and Montana.
- Oil wells recently drilled in mature producing states such as Ohio, Illinois, Michigan and Pennsylvania.
- Newly discovered gas supplies in Oregon (which in 1979 became the nation's 31st state producing natural gas).
- Old wells that are being brought back to productive life with enhanced recovery techniques.

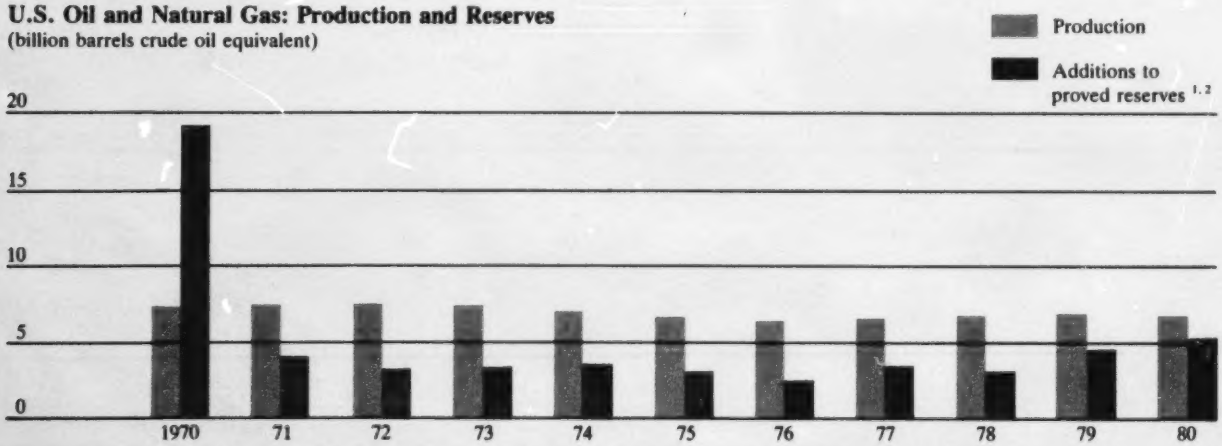
Proved Reserves: Signs of Hope

Accelerated drilling for oil and natural gas and increased recovery from existing fields have helped slow the rate of decline in proved U.S. reserves.

During most of the 1970s, the United States produced and delivered more oil and natural gas than it replaced with new discoveries. From 1971 to 1978, we used about twice as much oil and natural gas as we found.

But in 1979, additions to U.S. reserves equalled almost three-fourths of domestic production, according to American Petroleum Institute and American Gas Association estimates. (Completed figures for 1980 are not yet available from the Department of Energy, now solely responsible for preparing reserve estimates.)

U.S. Oil and Natural Gas: Production and Reserves
(billion barrels crude oil equivalent)



[1] 1970 includes 14.2 billion barrels from Alaska's North Slope.

[2] Figures for 1980 are estimates.

Sources: U.S. Bureau of Mines, Department of Energy, American Petroleum Institute, American Gas Association and Canadian Petroleum Association

Capital and Exploration Spending

Capital spending on exploration and production increased sharply in 1980—another good sign for domestic petroleum supplies. Twenty-five leading U.S. oil companies, together, spent an estimated $18.9 billion in 1980 in domestic capital outlays for exploration and development. This is 35 percent more than an estimated $14 billion spent in 1979.

Outlook

While the United States is now moving in the right direction toward finding more oil and natural gas, obstacles still hamper the nation's ability to realize the desirable reduction in oil imports.

The limiting factor over the next few decades is *not* the potential of U.S. oil and natural gas resources. The U.S. Geological Survey and others estimate that the United States could still produce more oil and natural gas in the future than it has produced since the petroleum industry began in 1859. That means potential future production of:

- 137 billion barrels of crude oil, 27 billion barrels of natural gas liquids, and
- 950 trillion cubic feet of natural gas (the equivalent of 167 billion barrels of oil).

These estimates do not include substantial amounts of oil and natural gas that are not now economic to produce—but that could become economic because of future changes in prices, costs or recovery technology. Nor do the estimates include oil and natural gas that may be produced from oil shale, tar sands, heavy oils, geopressured shales and brines, or several other sources of domestic energy.

How much U.S. oil and natural gas will be found and produced—and *how quickly*—depends to a large extent on continued progress in government leasing and regulatory policies, including price controls on most categories of natural gas, laws and regulations controlling the use of government land for much-needed energy exploration and development, and complex environmental laws and regulations that needlessly delay or deter energy projects. (These are discussed in greater detail later, under "Policy Choices for the Future.")

Today's evidence proves that appropriate decisions in these areas will increase the domestic oil and gas contribution toward the goal of cutting oil imports in half during the 1980s.

Other Energy Sources

While an improved outlook for U.S. oil and natural gas supplies is important for reduced dependence, these sources alone cannot solve America's energy supply problems.

Potential Resources

Fortunately, the United States is also rich in non-petroleum energy resources. Potentially recoverable U.S. energy includes:

- *Coal*—250 billion tons (1 trillion barrels of oil equivalent).
- *Oil shale*—600 billion barrels.
- *Tar sands*—30 billion barrels.
- *Uranium*—700,000 tons (47 billion barrels of oil equivalent).
- *Solar, geothermal and biomass energy and other renewable resources*—potentially inexhaustible.

Even without renewable energy, these other sources could provide several times the nation's estimated remaining resources of oil and natural gas combined.

Past Use of Non-Petroleum Resources

In the past, many fuels other than oil and natural gas were important sources of energy supplies. For example:

- *Wood*—met three-quarters of U.S. energy needs in the late 1800s.
- *Coal*—served as the nation's principal fuel until 1950.
- *Synthetic gas*—lit city streets in major cities in the 19th century.
- *Liquid fuel from coal*—powered German planes and tanks in World War II.

But the American choice over the last decade was to turn increasingly to oil imports—at first cheap and plentiful—to fill the growing gap between domestic supply of oil and natural gas and consumption. Other U.S. energy sources made little contribution.

New Progress

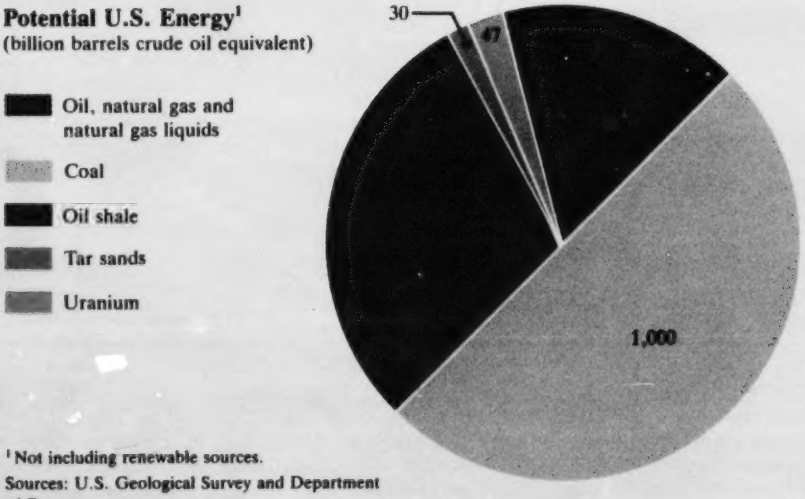
Rising world oil prices and interruptions in oil imports available to the United States in the 1970s focused new attention on America's non-petroleum resources as a means of helping reduce reliance on foreign oil. Significant recent progress has been encouraging. The 1980 highlights, compared with 1979:

- *Coal production*—up 7 percent, from 781.1 million tons in 1979 to 835.4 million tons in 1980—a record high.
- *Synthetic fuels*—closer to commercializaton.
- *Renewable energy sources*—stepped-up interest and investment.

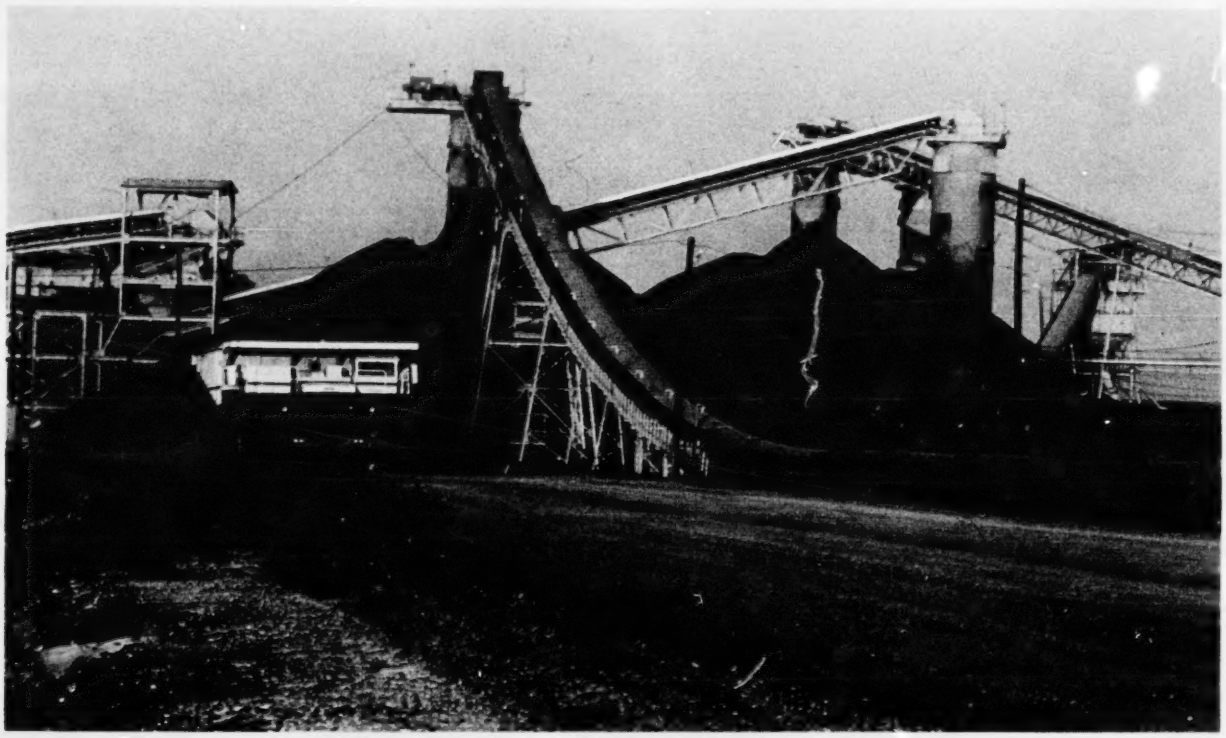
In all, non-petroleum energy sources accounted for 38.2 percent (11.6 million barrels a day of crude oil equivalent) of America's total energy production in 1980—up from 36.7 percent in 1979.

Nuclear power showed the only decline for non-petroleum fuels in 1980. The amount of electricity generated by nuclear power plants fell almost 2 percent, from 1.298 million

Potential U.S. Energy[1]
(billion barrels crude oil equivalent)



[1] Not including renewable sources.
Sources: U.S. Geological Survey and Department of Energy



An Indiana mine produces coal used by utilities to generate electricity.

barrels of crude oil equivalent in 1979 to 1.274 million barrels in 1980, although production of uranium was up 12 percent to a record high.

These alternatives to oil and natural gas could add substantially to U.S. energy supplies, and help the nation reduce its reliance on foreign oil during this decade. America has the resources to:

- Double its use of coal by 1990 to about 14 million to 15 million barrels a day of crude oil equivalent.
- Get significant new production from synthetic fuels and renewable resources—perhaps 2 million to 4 million barrels a day of crude oil equivalent by 1990.
- Triple the contribution of nuclear power by 1990 to some 4 million barrels a day of crude oil equivalent.

A source-by-source examination shows the status of non-petroleum energy in the United States.

Coal: Our Most Abundant Fossil Fuel

Coal accounts for nearly three-fourths of known recoverable conventional energy in the United States. America has more coal than OPEC has oil. More than one-half of the free world's total coal resources are in the United States.

Despite these vast supplies, coal provides only about one-fifth of U.S. energy, or 7.4 million barrels a day of crude oil equivalent. But coal has the potential to replace significant amounts of unreliable oil imports. Production has been constrained by low demand triggered by environmental concerns, by price controls on cleaner-burning natural gas and—until recently—by controls on oil.

Nevertheless, there are now encouraging signs that coal can, and will, contribute more to future American energy use. The statistics:

- *Coal use*—up 9 percent in 1979 over 1978; up 3 percent in 1980 over 1979.
- *Production*—up 17 percent in 1979 over 1978; up 7 percent in 1980 over 1979.
- *Share of U.S. energy supplied by coal*—up 1.4 percentage points in 1980 over 1979.
- *Productive capacity*—100 million tons a year above current levels of production.

Coal enlarged its share of U.S. energy production recently for several reasons. Utilities helped replace costly oil imports by stepping up their demand for cheaper and more reliably obtainable U.S. coal. Coal users stockpiled extra fuel to protect themselves from the risks of strikes, bad weather and oil supply emergencies. And coal exports—chiefly to Japan, Canada and Western Europe—rose substantially.

More progress for coal is expected in the future.

First, electric utilities, the major coal users in the United States, have announced plans to expand their coal-burning facilities in the 1980s—a sign that utilities will need less foreign oil.

Second, analysts expect the export market for American coal to continue to grow. Exports of coal can improve the U.S. balance of payments. They can also help other nations reduce their dependence on OPEC oil, which could have an impact on OPEC prices.

Finally, government took an important, positive step in January 1981 by lifting a 10-year ban on leasing federal coal lands. Federal lands may hold as much as two-fifths of remaining U.S. coal deposits.

If America's vast reserves are developed, coal can add significantly to U.S. energy supplies—perhaps doubling its contribution by 1990.

Synthetic Fuels: Vast Resources

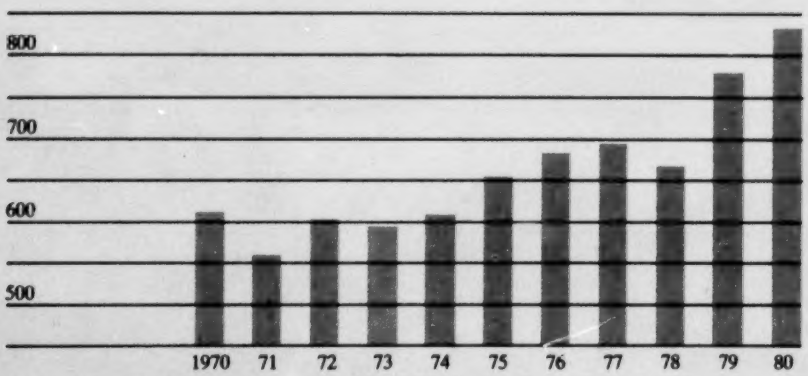
Oil and gas from coal. Soon, coal will contribute to America's energy supplies in other ways.

The rapid rise in OPEC oil prices has spurred research and development of processes to turn coal into synthetic oil and gas—fuels which can heat homes and power motor vehicles. More than 15 oil companies are actively engaged in this effort. Several technologies are close to commercialization.

Some U.S. projects, for example:

- A 100-megawatt coal gasification plant is planned for the Mojave desert, financed by Texaco, Southern California Edison, General Electric, the Electric Power Research Institute and the Bechtel Corporation.
- A Baytown, Texas coal liquefaction pilot plant built by Exxon is converting 250 tons of coal into 450 barrels of oil a day.
- A project being developed by W.R. Grace Company in Baskett, Kentucky will use the Mobil methanol-to-gasoline process along with a Texaco gasification process to convert 25,000 tons of coal into 50,000 barrels of gasoline a day.
- A group of companies—including Ashland Oil, Inc., Conoco Coal Development Company, Mobil

U.S. Coal Production
(million short tons)



Source: Department of Energy

U.S. Coal: Contribution and Potential

Coal's Share of 1980 U.S. Energy Consumption

Coal's Share of Recoverable U.S. Conventional Energy

Sources: U.S. Geological Survey and Department of Energy

Oil Corporation and Standard Oil Company (Indiana)—is converting 600 tons of coal into 1,800 barrels of oil daily at a pilot plant in Cattletsburg, Kentucky.

In all, some 41 pilot, demonstration or commercial coal gasification and liquefaction facilities are operating in the United States, according to a 1980 survey by the National Coal Association. Six others were being built, and 42 more were in the planning stages.

This stepped-up activity is a good sign for future synthetic fuels production from coal. Some analysts have estimated that 1990 production could provide:

- *Gas from coal*—200,000 to 500,000 barrels of oil equivalent a day.
- *Oil from coal*—100,000 to 300,000 barrels a day.

Oil shale. Potential U.S. reserves of oil producible from laminated marlstone, or oil shale, are estimated to be greater than the total crude oil reserves of the free world.

Two dozen or more companies are working to develop oil shale in the United States. Examples of projects include:

- *"Colony" project* (Exxon Corporation and The Oil Shale Corporation [Tosco])—47,000 barrels a day by 1985.
- *"Cathedral Bluffs" project* (Occidental Petroleum Corporation and Tenneco Inc.)—94,000 barrels a day by 1990.

Some 80 percent of Western oil shale resources are estimated to lie under federal lands. Some analysts have estimated that by the close of the decade, oil shale could provide the United States 200,000 to 300,000 barrels of oil a day.

Tar sands. Deposits of sand saturated with oil or tar also could in time help reduce U.S. dependence on unreliable oil imports.

The U.S. Department of the Interior estimates American tar sands deposits to be about 30 billion barrels—an amount greater than today's proved reserves of crude oil. Most U.S. tar sands deposits are in Utah, although lesser amounts are located in 21 other states.

Tar sands research and development projects are being conducted by several companies, including Chevron U.S.A. Inc.; Conoco Inc.; Getty Oil Corporation; Phillips Petroleum Company; The Pittston Company; Santa Fe Industries, Inc.; The Standard Oil Company (Ohio); Sun Company, Inc. and Texaco Inc.

In August 1980, a 15-year moratorium on leasing federal lands for tar sands development was lifted. About 75 percent of tar sands resources are estimated to lie under federal lands.

In recent years, development of synthetic fuels has moved closer to becoming competitive with foreign oil—a promise of future progress.

These figures suggest that synthetic fuels—from coal, oil shale and, to a lesser extent, tar sands—could supply as much as 1.3 million barrels a day of oil equivalent by 1990, according to some analysts.

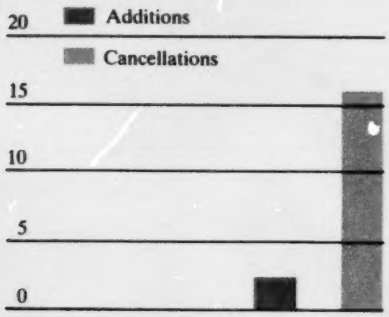
Of course, the rate and extent of synfuels development will depend on many factors, especially their

Solar collectors on the roof of a Bronx high school put the sun's energy to work to heat water for the school.

A Chicago pilot plant produces synthetic gas from coal. Experiments in manufacturing gas from peat are also under way at this facility.

Technology can release on a massive scale the energy trapped in oil shale.

U.S. Nuclear Generation Capacity: 1980 Additions and Cancellations
(million kilowatts)



Source: Department of Energy

competitiveness with other conventional and unconventional energy sources. If economic conditions encourage their development, synfuels could make a substantial contribution to the nation's energy needs by the end of the decade and, given their enormous potential, a far greater contribution thereafter.

Nuclear Power: Unfulfilled Potential

Nuclear power can also add substantially to the nation's energy supply, although problems have set back progress in recent years:

- *Moratorium*—A moratorium on licensing new power plants, imposed after the Three Mile Island accident, lasted until February 1980.
- *Delays*—Congress only recently began to address the problem of review and permitting delays.
- *Waste disposal*—Rules for storage of spent fuel and disposal of wastes have not been put in place.

As a result of these problems, 14 planned power reactors were cancelled in 1980, while only four were licensed—reducing total existing and planned generating capacity by 16 million kilowatts. That is enough energy to meet the needs of 4.25 million homes for a full year.

Electricity produced by nuclear power plants was down in 1980 by 1.6 percent from 1979. In contrast, nuclear power generation by more than a dozen other non-communist nations rose by 17.5 percent.

Despite these difficulties, the 75 nuclear reactors now in operation in the United States generated 11 percent of the nation's electrical power in 1980. Nuclear power has replaced oil as the second leading source, after coal, for the generation of electricity.

Most analysts expect substantial gains to be made in nuclear power generation in the 1980s, if timely and consistent government decisions on nuclear issues are made. As noted earlier, nuclear power's contribution could triple by 1990 if plants under construction or on order are completed in the 1980s—helping the United States move closer to the goal of reducing oil imports by half during the decade.

Renewable Energy: Over, Under and All Around Us

Renewable energy is energy from natural resources: the sun, the earth's own heat (geothermal energy), the oceans, the winds and the conversion of organic substances into fuels (biomass).

Some analysts believe that these different forms of renewable energy could provide the oil equivalent of from 0.75 million to 1.5 million barrels a day by 1990.

A brief progress report:

Solar energy. Solar energy now accounts for less than one-tenth of 1 percent of total U.S. energy production. But progress is being made in increasing solar power's contribution. Producer shipments of solar collectors—which absorb sunlight to heat homes and swimming pools, for example—climbed to 19.46 million square feet in 1980 (an increase of 37 percent over 1979).

Geothermal energy. Production of electricity from geothermal sources—chiefly by Union Oil in California—was up by more than 30 percent in 1980 over 1979. By 1990, analysts estimate that geothermal energy could provide the oil equivalent of 100,000 barrels a day.

Oceans. Experiments in using the ocean's waves, tides and temperature variations to harness the enormous energy of the sea are underway.

For example, the Hawaiian Electric Company (which now relies on oil to generate 97 percent of its electricity) estimates that energy from

the ocean could provide as much as 70 percent of the peak electric power needed on the island of Oahu.

Winds. Wind power is not expected to be a major energy contributor by 1990. But, according to Department of Energy estimates, wind power may supply from 2 to 3 percent of U.S. energy needs by the year 2000. One experimental wind project in Goldendale, Washington provides 7,500 kilowatts of electricity, or enough to meet the needs of 2,000 homes.

Biomass. Energy from biomass—from cornstalks to municipal wastes—could supply from 200,000 to 300,000 barrels a day of oil equivalent by 1990.

As in the case of synfuels, the contribution of renewable energy will depend upon its competitiveness with other energy sources. Regardless of their actual contribution as early as 1990, however, solar and other renewable sources hold tremendous promise for the nation's long-term energy future.

Outlook

Alternatives to oil and natural gas clearly can provide the United States with much-needed substitutes for foreign oil.

Some fuels, like coal, can be pressed into broader service fairly quickly. Others, such as solar cells, will require both time and technological breakthroughs before they can make substantial contributions—although, in time, the solar role inevitably will be large.

Increased world oil prices have helped to make these non-petroleum resources more competitive with imported oil, although many remain high-cost alternatives. Several problems delay the progress of alternative fuels.

As in the case of oil and natural gas, government policies on access to government lands and environmental regulations will largely determine the speed and extent of future contributions by coal and synfuels to the nation's energy needs. The development of nuclear power, again, requires steps by government to resolve remaining issues. And major contributions from renewable energy sources will depend upon their costs becoming competitive with other sources.

If these obstacles are overcome—and they can be—coal can add very quickly to total U.S. energy supplies. Other domestic alternatives to oil and natural gas will take longer to develop—but their potential contribution is enormous.

Fortunately, the United States again is turning in the right direction—toward economical use of our vast resources of non-petroleum energy to help reach the goal of reducing U.S. dependence on oil imports.

Energy Conservation

Increased production is only one part of the solution to our energy problems. Energy conservation is the other major—and indispensable—part.

Statistics show that the United States is cutting its energy use much more quickly, and to a much larger extent, than most people thought possible only a few years ago.

The good news:

- *1980 energy use—down* almost 4 percent from 1979.
- *1981 energy use (first quarter)—down* more than 9 percent from the first quarter of 1980.

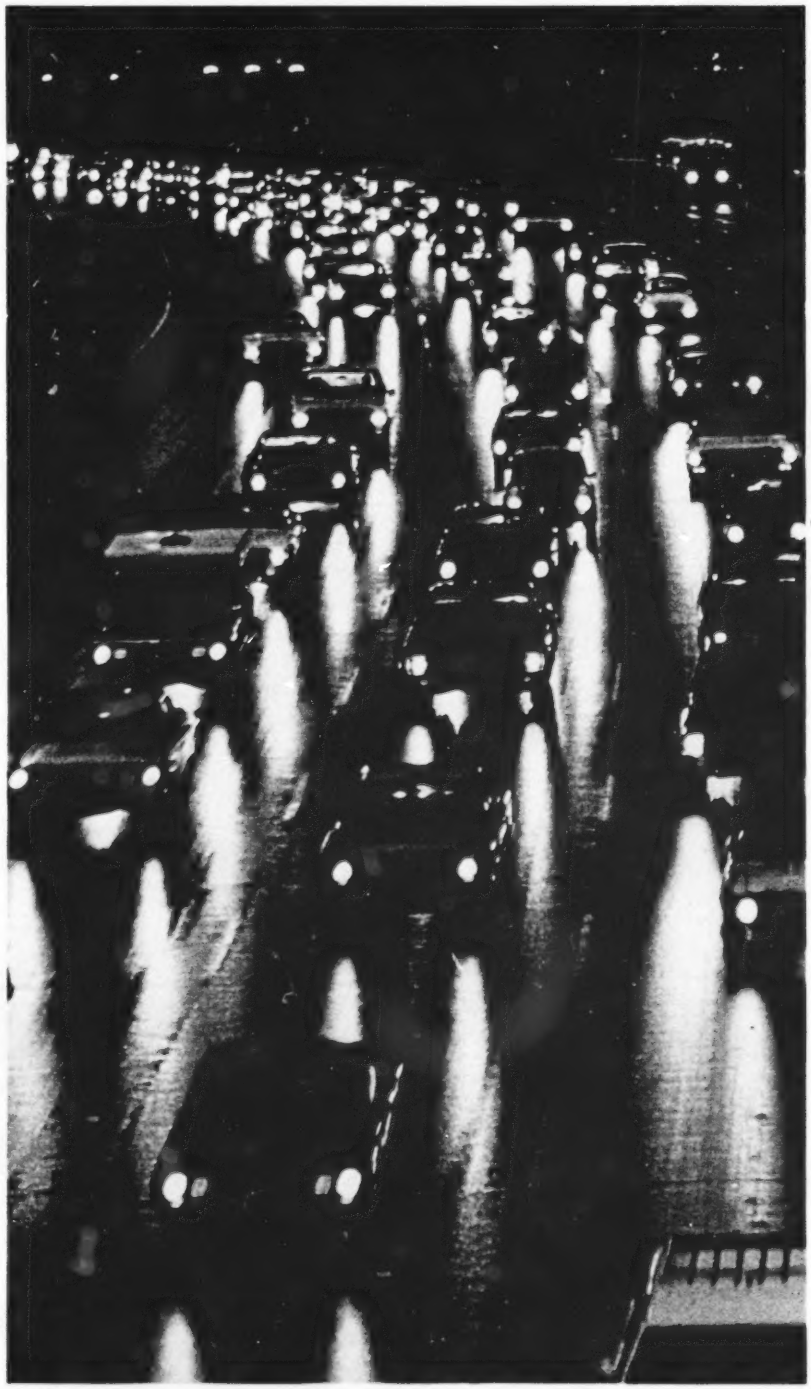
This progress in overall energy conservation has been reflected in Americans' use of oil—especially imported oil—which has dropped sharply in the past several years:

- *1980 oil use—down* more than 8 percent from 1979.
- *1980 oil imports—down* more than 19 percent from 1979.
- *1981 oil use (first half)—down* almost 7 percent from the first half of 1980.
- *1981 oil imports (first half)—down* almost another 20 percent from the first half of 1980.

These dramatic reductions in oil use have resulted both from more efficient use of petroleum products and from substitution of other energy sources for those products ("fuel-switching").

The breakdown of consumption by major petroleum products:

- *Gasoline—down* about 6.5 percent in 1980 from 1979, and down almost 6.4 percent in the first half of 1981 from the first half of 1980.
- *Distillate*—down* more than 13 percent in 1980 from 1979, and down more than 4 percent in the first half of 1981 from the first half of 1980.



*Distillate—used chiefly as home heating oil and diesel fuel.

- *Residual oil** —*down* almost 12 percent in 1980 from 1979, and down more than 17 percent in the first half of 1981 from the first half of 1980.

Previous Trends

Such developments in energy use are especially striking when compared with previous trends.

For more than a decade before the Arab oil embargo in 1973–74, Americans *increased* their energy use by an average of about 4 percent each year. Growth in consumption was spurred by:

- Reliable energy supplies.
- Generally stable—or declining—"real" energy prices.**

As the 1970s began, analysts expected consumption to continue to climb throughout the decade.

But the oil embargo of 1973–1974 changed this outlook. World oil prices rose fourfold. Recession dampened the economic activity—and energy consumption—of most industrialized nations. In the United States energy use dropped, and a new era of more expensive energy began.

Due to artificially suppressed domestic oil and natural gas prices in this country, the full impact of this new reality was partially obscured for many Americans. American consumers were not encouraged to use oil and natural gas as efficiently as they would have otherwise. Still, some price increases occurred under government regulation and consumers responded by turning to more efficient—and economic—ways of using energy.

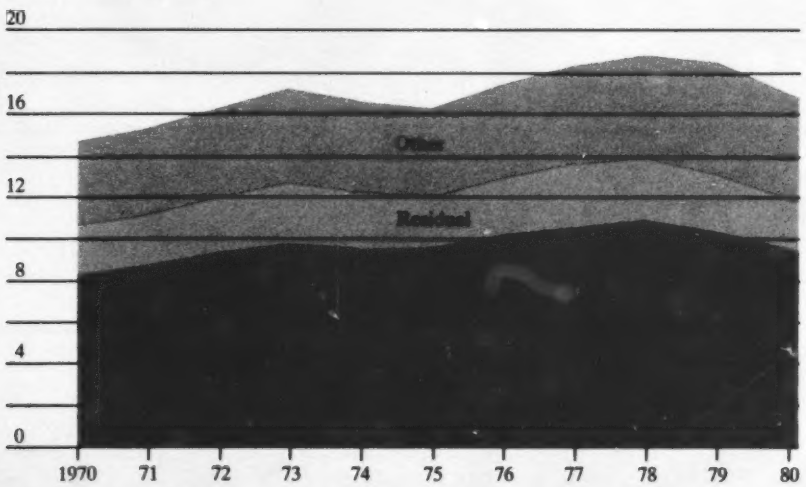
The search for greater energy efficiency was intensified when world prices rose a further twofold, in the wake of the Iranian revolution, in early 1979. And the decision of the U.S. government later that year to begin letting more U.S. oil be priced competitively with foreign oil encouraged consumers to use oil more efficiently than in the past.

The results of this growing response to the new era of more costly energy have been dramatic. Americans now have a much more energy-

*Residual oil—heavier oil used by utilities and industry.

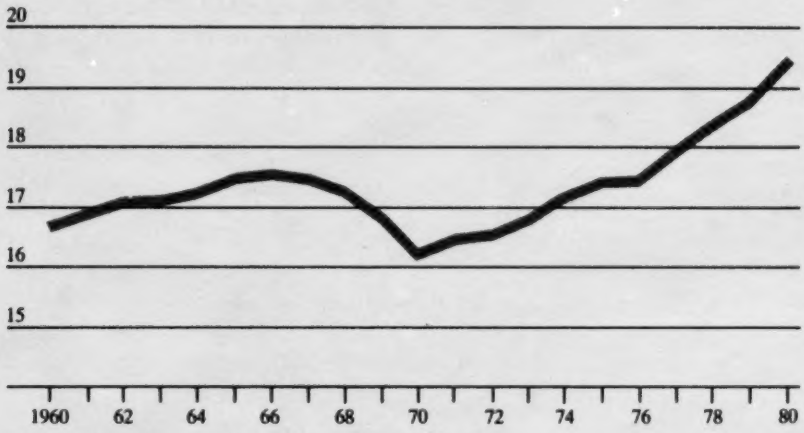
**"Real" prices are adjusted for inflation.

U.S. Oil Consumption by Product
(million barrels per day)



Source: Department of Energy

Economic Output Per Unit of Energy
(Gross National Product per quadrillion Btus in billions of 1972 dollars)



Sources: *Survey of Current Business* and Department of Energy

efficient economy than they had before the embargo. And, while making this progress, Americans were able to increase their standard of living during the 1970s at a pace that surprised many analysts.

A Look at Energy Use and GNP

A comparison of energy use and America's Gross National Product (GNP)* shows that recent gains in overall U.S. energy efficiency have been substantial.

Before the Arab oil embargo, energy use and GNP grew at almost exactly the same rate. In each year from 1963 through 1973:

- *Energy consumption* rose an average of 4.4 percent.
- *Real GNP* rose an average of 4.1 percent.

In other words, for every 1 percent of economic growth, energy use also grew by about 1 percent.

But from 1973 through 1979:

- *Energy consumption* grew by an average of less than 1 percent.
- *Real GNP* grew by an average of 2.5 percent.

Thus, for those seven years, a nearly 3 percent increase in GNP required only a 1 percent increase in energy use. This means that Americans in 1979 used about 12 percent less energy for each "real" dollar of GNP than they used in 1972. And in 1980 there was another 3 percent reduction in the amount of energy used for each real dollar of GNP.

Energy Efficiency

Americans have made impressive progress in conserving energy by using it more efficiently. Some examples:

- Farmers are reducing their use of diesel fuel by methods of crop tillage which cut consumption by as much as 80 percent, according to the U.S. Department of Agriculture.
- Between 1972 and 1980, U.S. oil refiners cut their annual energy use by the equivalent of more than a year's heating oil consumption for all of New England.
- Use by industries of heat recuperators, insulation, energy management systems, more efficient electric motors and lights, steam traps and ceiling fans saved the equivalent of 850 million barrels

*GNP is a commonly used yardstick of an economy's production of goods and services.

of oil in 1979—or about 3.5 months' worth of oil imports.

Total spending for energy efficiency in 1980 amounted to $8.7 billion, according to *Business Week*. That was:

- Twice the amount spent in 1979.
- Greater than the combined spending of the preceding five years.

Energy Use by Sector

Analysts divide energy use into consumption by three sectors: transportation, residential and commercial, and industrial. A brief look at each of these provides a breakdown of U.S. progress in increasing energy conservation.

Transportation Sector

Transportation posted the most impressive recent reductions in U.S. energy use—a decline of some 10 percent in 1980 from 1978 levels.

In contrast, from 1965 through 1973, transportation energy use rose by an average of some 5 percent annually. Quadrupled world oil prices in the wake of the Arab oil embargo prompted declines in transportation sector consumption in 1974 and 1975. But energy use climbed again from 1976 to 1978 as motorists, encouraged by declining real prices of gasoline, returned to old driving habits and larger cars.

The sharp drop in total energy use by the transportation sector came in 1979 and 1980, after the Iranian revolution caused fuel prices to escalate again. (Energy used in the transportation sector, of course, is obtained almost entirely from oil.)

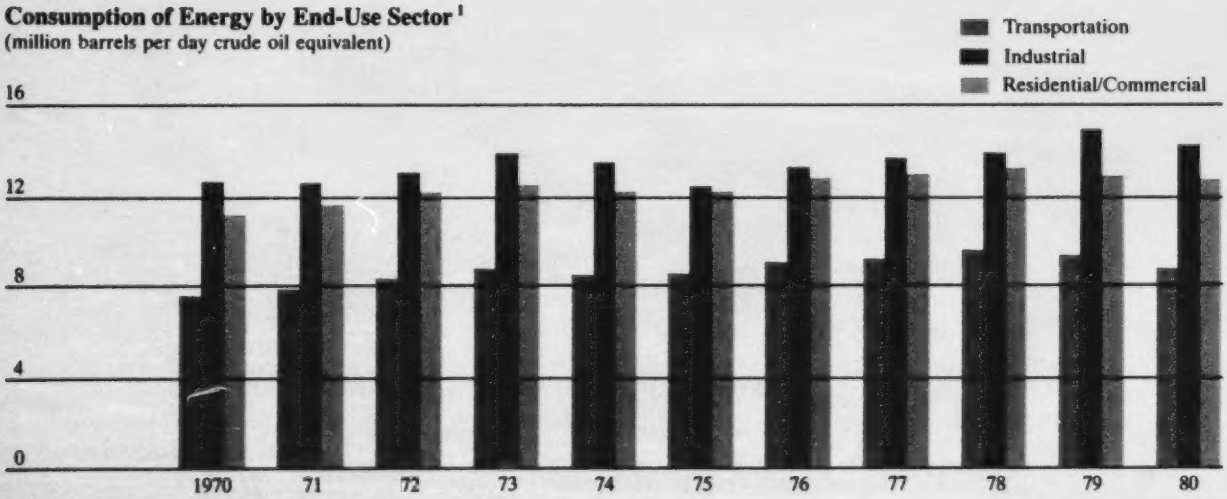
Greater efficiency—rather than reduction in driving—was the major cause of recent cuts in gasoline consumption, which accounts for almost 70 percent of transportation energy use. In 1980, compared with 1979:

- *Gasoline use* dropped 6.5 percent.
- *Miles driven* declined only 1 percent.

The Congressional Budget Office estimates that improvements in fuel economy since 1974 have resulted in savings of more than 700,000 barrels of oil a day in 1980. Average fuel efficiency for new passenger vehicles was:

- 14.2 miles per gallon in 1974.
- 23.4 miles per gallon in 1980.

Consumption of Energy by End-Use Sector [1]
(million barrels per day crude oil equivalent)



[1]Electrical energy losses distributed to consuming sectors.
Source: Department of Energy

Participants in an energy-saving van pool program in Houston head home after work.

Current government standards require the fuel economy of new automobiles sold in 1985 to average 27.5 miles a gallon. Automotive industry forecasts of fuel efficiency for new cars now exceed those mandates, suggesting an industry fleet average of 30 miles a gallon by 1985.

Further efficiency improvements for transportation—the sector most heavily dependent on petroleum—can make a substantial contribution to American efforts to reduce oil imports.

Residential/Commercial Sector

The residential and commercial sector, in which space heating accounts for about 50 percent of demand, used 3 percent less energy in 1980 than in 1978. The Bureau of the Census estimates that during the same period, more than 3 million public and private housing starts were made.

Recent gains in energy conservation were in sharp contrast to earlier trends. From 1965 to 1972, these sectors *increased* their energy use by an average of more than 5.4 percent a year. Residential and commercial users reduced consumption briefly after the Arab oil embargo brought oil price increases, but energy use began to rise again in 1976, 1977 and 1978.

However, energy efficiency increases—begun soon after the embargo—finally culminated in the 3 percent cut in energy use between 1978 and 1980—only the second period of decline in the last two decades.

For example, in 1979 (the latest year for which figures are available):

- 13 percent of new homeowners added insulation.
- Builders spent some $714 per new house on insulation (compared with $147 in 1972).

New designs for residential and commercial structures are considerably more efficient than before, according to a survey made by the American Institute of Architects (AIA) Research Corporation. Although comparable data are not available for pre-embargo times, AIA believes that new designs will produce buildings that are at least 20 percent more energy efficient than existing buildings. According to the AIA, 40 to 50 percent improvements will soon be routine.

Improved efficiency in older buildings and construction of more efficient new buildings can continue to increase in the decade ahead—bringing significant energy savings

without major changes in individual lifestyles.

Industrial Sector

American industry—including agriculture, construction, mining and manufacturing—decreased its total energy use by 4 percent in 1980 over 1979. Industry has made the steadiest gains in energy efficiency of any sector.

After World War II, the industrial sector was consuming almost twice as much energy as households and commercial establishments. But in 1980, industry used only about 11 percent more energy than the residential and commercial sector. This is partly because industrial energy users, who are extremely sensitive to price changes, have been working for years to cut energy costs by increasing their efficiency. A study by the National Association of Manufacturers found that the industrial sector accounted for over 60 percent of the nation's overall improvement in energy efficiency from 1973 to 1978, according to *Industry Week*.

Industrial production during the five-year period 1973–78 rose more than 12 percent, while industrial use of energy *dropped* by more than 1 percent—roughly a 13 percent overall improvement in energy productivity.

Progress for the 10 most energy-intensive industries* in the United States has been especially striking.

Between 1972 and 1979, these industries, which account for more than 90 percent of the energy purchased by U.S. manufacturers:

- *Cut energy consumption* by more than 2 percent while increasing production by 17 percent.
- *Improved efficiency* by 15 percent.

*The ten are chemicals; primary metals; petroleum and coal; stone, clay and glass; paper; food; fabricated metals; transportation equipment; machinery and textiles.

Analysts expect progress to continue, as the industrial sector invests even more in both research and capital equipment to increase energy efficiency.

Fuel-Switching

As noted earlier, total oil use in 1980 dropped more quickly than total energy use, chiefly because of fuel-switching. For the most part, this fuel-switching occurred when consumers found that another fuel was more economical to use than oil. Many energy users moved to coal during 1980 because of its relatively low cost and because coal producers increased production substantially over 1979.

Electric utilities were an important group of users who increased their use of coal during 1980—by almost 8 percent more than 1979. During the same period, utilities:

- Reduced their use of oil by more than 100 million barrels.
- Increased their generation of electricity by about 40 billion kilowatt-hours.

These figures show that electric utilities underwent considerable change during 1980—even though their total use of energy increased by a seemingly small amount: less than 3 percent compared with 1979.

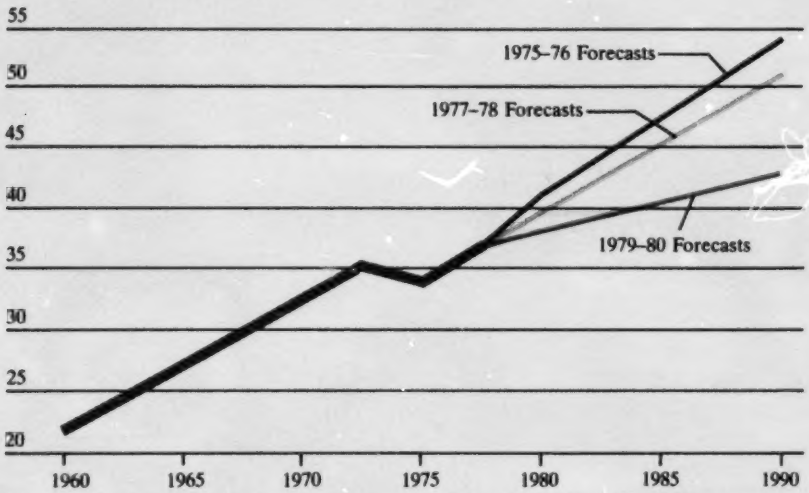
Outlook

America appears to be firmly established on the path toward increased energy conservation in the 1980s.

Estimates of future U.S. energy consumption have been falling continuously since the oil embargo. Forecasts of 1980 energy consumption made in the early 1970s have turned out to be 25 percent or more *above* actual 1980 energy use—chiefly because of the unexpected price increases over the decade. Analysts who projected in the 1970s that Americans would use

Workers at a Mississippi oil refinery adjust insulation to reduce energy loss on a "heat exchanger," which transfers heat from one fluid to another.

Forecasts of Energy Use
(million barrels per day crude oil equivalent)



This chart—based on published forecasts from government, business, industry and other sources—shows how the trend toward energy conservation has caused forecasts to drop substantially over the last few years.

as much as 55 million barrels of oil equivalent daily in 1990 have now scaled their estimates down to as little as 40.5 million barrels a day.

Most analysts believe that energy efficiency will continue to improve for some time to come. The Department of Energy predicts that:

- Commercial buildings constructed in 1990 will be as much as 35 percent more efficient than in 1977.
- Average miles per gallon of all U.S. automobiles on the road will rise to 22.3 by 1990, from 14.3 in 1979.

Despite such continued improvement, conservation alone cannot solve the nation's energy problems. Recent energy forecasts show that, even with continued conservation, the United States will need more total energy in 1990 than in 1980. The Department of Energy projects that the nation will need the equivalent of 41.1 million barrels of oil a day in 1990, compared with actual use of the equivalent of 35.9 million barrels a day in 1980. And, as our energy use increases, oil imports will grow unless domestic energy production from all sources also increases.

However, as part of a total program to reduce oil imports—one which also relies on increased energy production—conservation *can* and *must* make a substantial contribution. Today's progress offers new hope that the United States can keep increasing energy-use efficiency throughout the 1980s—and continue to move toward the goal of reducing reliance on imported oil by half during the decade.

The Risk of International Emergency

This report has emphasized that the prospects for cutting oil imports by half in the 1980s have improved, but the nation has not solved its problems. The United States—and its allies—still face the risk of international oil supply emergencies.

U.S. Imports

Despite the dramatic 1980 cut in oil imports, the United States in 1981 was still buying:

- 35 percent of its oil from foreign countries.
- More than one-fourth of that foreign oil from the troubled Persian Gulf area.

The cutoff dangers of 1973 and 1979 have not disappeared. And the war between Iran and Iraq, begun in 1980, once again demonstrated the potential instability of oil imports. The Department of Energy has estimated that there is a 75 percent probability of another oil supply disruption in the 1980s.

American Allies

What is more, many of America's allies are far more dependent than the United States on oil from the Persian Gulf. The statistics for 1980:

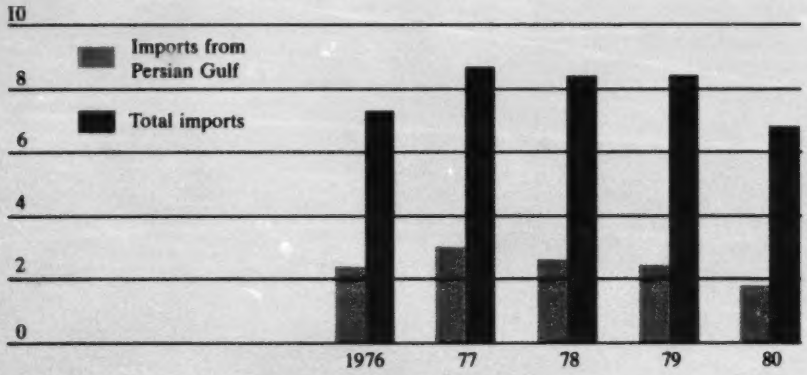
	Percent of Oil Imported	Percent of Oil Imports from Persian Gulf
France	99%	63%
Italy	98%	46%
W. Germany	97%	31%
Japan	99%	69%

Close economic, political and social ties among the allies—and the fact that oil is sold in a world market—ensure that a shortage of oil available for import which affects one country will affect *all* oil-importing countries. This international interdependence was formally recognized in 1974 when a number of oil-importing nations* agreed to share supplies under certain emergency conditions.

The United States is bound by custom, international law, and our own security interests to be concerned about the risks of oil supply disruptions to other nations, not just our own.

*The members of the group, called the International Energy Agency (IEA), are Australia, Austria, Belgium, Canada, Denmark, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

U.S. Oil Imports
(million barrels per day)



Source: Central Intelligence Agency

A massive drilling platform searches for petroleum below the cold waters of the North Sea at a depth of 530 feet.

Government price and allocation controls left many stations short of gasoline during two oil-import disruptions in the 1970s.

What Our Allies Are Doing

Many U.S. allies have embarked on ambitious programs to increase domestic energy production and reduce imports. For example:

- Other free world nations (not including the United States) increased nuclear generation of electricity by 18.1 percent in 1980 compared with 1979.
- Japan cut both its total oil consumption and its total oil imports by over 9 percent in 1980 compared with 1979.
- Britain and Norway more than doubled their combined oil production in 1980 compared with 1977, helped by the development of North Sea discoveries made in the early 1970s. The total of oil production for the two countries increased from 1 million barrels a day in 1977 to 2.2 million barrels a day in 1980.

America's Contribution

America can play a leading role in reducing the West's vulnerability to oil supply disruptions. The reasons:

- We *use* more energy than any other nation of the free world.
- We have the resources to *produce* more energy than any other free world nation.

Thus, although the United States cannot solve the energy problems of the West by itself, its contribution can be substantial. Our best approach is to lessen our own vulnerability to import reductions. That means:

- *Continuing to increase energy production and conservation.*
- *Using past experience to make workable plans to deal with emergencies.*

Dealing with Emergencies

Analysts agree that the United States did not effectively deal with the energy emergencies of recent years.

When the 1973–74 Arab oil embargo and the 1979 Iranian revolution cut off some oil supplies to the United States, the nation relied on government intervention in energy markets to deal with the crises. Federal price and allocation controls were expected to hold oil prices down and to distribute supplies fairly.

Instead, controls made supply problems worse. By disrupting domestic energy markets—which could deal with shortfalls more efficiently than government regulation—controls actually:

- Stimulated energy consumption.
- Discouraged domestic production.
- Prompted "hoarding" in a time of shortage.
- Allocated supplies inequitably.

As a result, two relatively small supply reductions (each representing no more than 5 percent of total U.S. oil supplies) became serious shortages in many parts of the country.

Furthermore, by stimulating U.S. demand for oil imports, regulation helped make it possible, ultimately, for foreign oil producers to raise their prices even higher. At best,

controls forestalled price increases to consumers only briefly.

Lessons Learned

Experience has taught America some hard lessons about dealing with oil supply emergencies. The nation can benefit especially from two of those lessons in possible future crises.

The role of the market. The United States has learned that the market system—which has successfully handled the distribution of goods in this country throughout almost all of its history—can more efficiently minimize the adverse effects of energy shortages than rigid government regulation.

During supply disruptions—or at any other time—the most effective policy will:

- Encourage energy conservation.
- Stimulate energy production.

Market incentives do both. Government controls do neither.

In an emergency, the most effective policy should also be flexible enough to allocate scarce oil supplies as smoothly as possible:

- The market system can react to changes in demand quickly to get oil supplies where they are needed most, when they are needed most.
- Government allocations, in contrast, have been inflexibly based on historical consumption patterns and politically determined priorities.

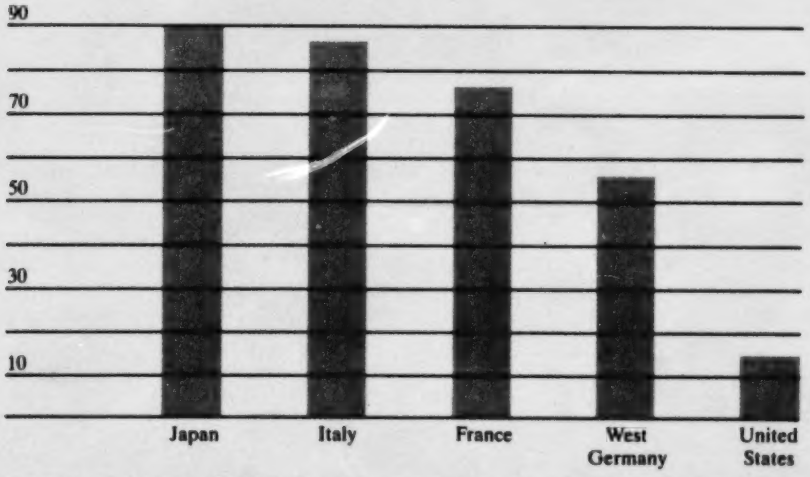
Finally, the most effective policy for dealing with supply shortages is the one that will cost Americans the least. A Department of Energy study has concluded that the loss in Gross National Product is 30 percent less when a shortage is resolved through market-pricing than through government controls.

Neither government nor the market can prevent all hardship resulting from oil supply disruptions. But most analysts agree that the U.S. market system can more effectively keep such hardship to a minimum.

The role of government. The United States has learned from past experience that government also has an important role to play in reducing the impact of any future energy crisis. It has the resources and the authority to:

- Build up stocks of crude oil in the Strategic Petroleum Reserve to

Dependence of Selected Countries on Imported Energy in 1980
(imported energy as percent of total energy use)



Sources: European Economic Community, Department of Energy and Business Information Display, Inc.

help cushion the nation from the effects of shortages. The rate at which the reserve was being filled increased sharply in early 1981, and continued timely build-up of stocks is of critical importance to the energy security of the United States.

- Encourage communication and cooperation between government and the private sector during shortages—as occurred during other fuel crises, including those during both world wars.

If reductions in oil supplies in a future crisis are very large, some form of further government action may be appropriate. But experience teaches that intervention should be:

- *Brief*—Any market controls should be allowed to expire as soon as their work is done, so that progress toward import reductions is not needlessly slowed.
- *Flexible*—Government should be able to respond to variables such as public and private stock levels and weather conditions—not be locked into a pre-set plan.

By basing sensible emergency plans on the lessons the United States has learned from past shortages, the nation can better manage possible future crises.

Increasing Energy Production and Conservation

The best emergency planning, of course, is that which helps to *forestall* emergencies.

To avoid future energy crises, America must continue to reduce oil imports from unstable regions of the world. *That means turning recent progress into long-term trends.*

Gains in energy conservation and production have been shown to improve America's ability to cope with oil supply disruptions.

When war broke out between Iraq and Iran in 1980, total available free world oil supplies were initially reduced by some 3 million to 4 million barrels a day, from roughly 46 million barrels per day to about 42 million barrels per day. Yet, in contrast to early shortages, world oil prices were not rapidly bid up and Americans did not wait in gasoline lines.

The United States was able to weather the crisis for several reasons:

- Unusually high stocks of oil provided a supply cushion.
- World recession partly reduced demand.
- Stepped-up production by other suppliers helped compensate for the shortfall.
- The government did not intervene with allocation of supplies.

A change in U.S. government policy also helped protect America from the possible effects of a shortage. Phased decontrol of oil prices, begun in 1979, allowed market incentives to encourage energy conservation and production—and to forestall possible supply problems.

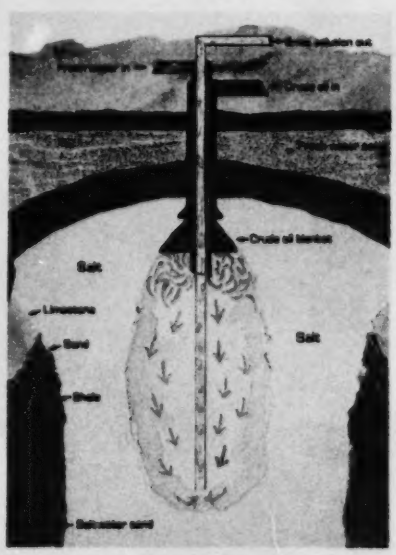
The Instability of Supply

The slight worldwide oversupply of oil which helped cushion oil-importing nations from the supply interruptions that occurred during the war between Iraq and Iran could be temporary. The situation could change rapidly with:

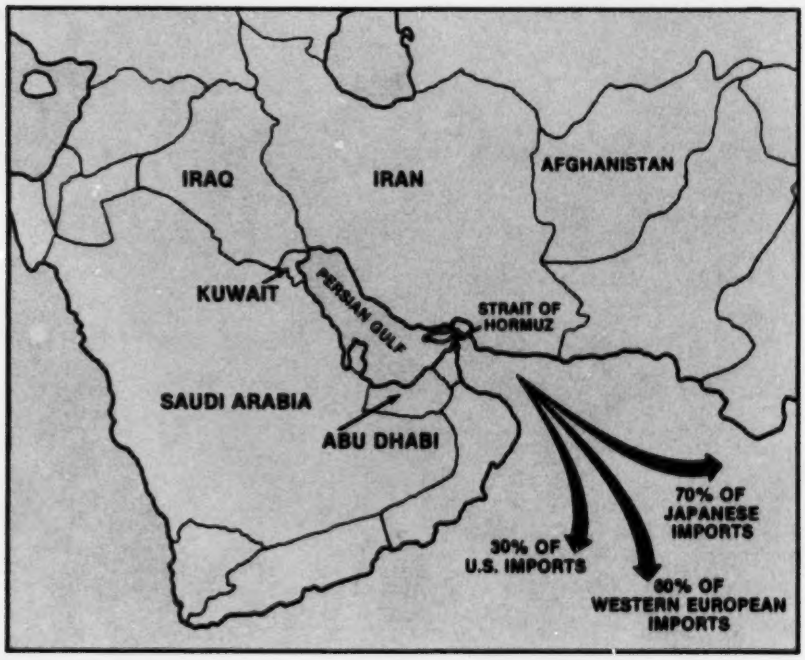
- A sudden cut in oil production from major producing countries.
- Further conflict in the Middle East.
- Abrupt or unexpected increases in energy consumption.
- A strong upturn in economic activity in the leading industrialized nations.

Cutting U.S. dependence on unreliable oil imports is, therefore, as critical as ever. Very small changes in the amount of oil available on the world market can still create major problems.

Enormous caverns, created when underground salt domes are dissolved with pressurized water, hold the nation's Strategic Petroleum Reserve.



Oil Imports From Persian Gulf Countries



Further, a large disruption of oil supplies in the future cannot be ruled out. The effects of such a loss could be staggering. For example, the Congressional Budget Office estimated in 1980 that a cutoff of Saudi Arabian oil for one year would:

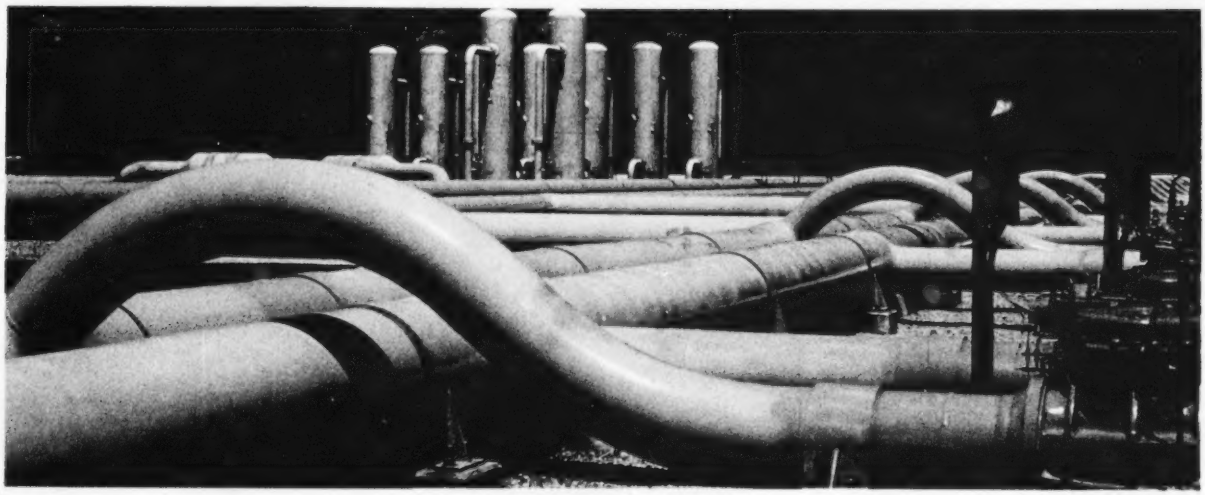
- Cost the United States nearly $300 billion.
- Force up unemployment by 2 percent.
- Increase the inflation rate by 20 percent.

Conclusion

The risk of international supply emergencies in the 1980s is still grave. But the United States can make a major contribution to Western efforts to minimize that risk.

America's recent dramatic progress in reducing oil imports has already improved its ability to manage supply disruptions. With continued progress in energy production and conservation and sensible emergency planning—including the rapid filling of the Strategic Petroleum Reserve—the United States can move even closer to energy security through substantial import reductions in the 1980s.

Policy Choices for the Future



More clean-burning natural gas—here being processed through dehydrators and scrubbers to ensure uniform quality—would be available to U.S. consumers under deregulation.

As this report has noted, America is turning in the right direction. With decontrol of U.S. oil prices government has provided a freer, more competitive energy market. But, there are other constructive and specific policy choices available to the nation—practical ways of assuring that U.S. energy progress continues.

Natural Gas Price Controls

Natural gas is the only fuel that remained under federal price controls after January 1981. The removal of these controls could produce dramatic benefits similar to those brought by oil decontrol. Natural gas deregulation would:

- Stimulate exploration and production.
- Help assure sufficient supplies.
- Encourage efficient use of natural gas.
- Reduce oil imports through substitution of more plentiful, reliable domestic natural gas.

The Natural Gas Policy Act. Many have the impression that recent legislation has already removed natural gas price controls. But that is not the case. In fact, the Natural Gas Policy Act of 1978 (NGPA):

- *Extended* federal controls to formerly unregulated markets within states (controls already applied to the interstate market).
- *Complicated* federal controls by creating some 23 categories of natural gas, each with its own price and its own set of rules.
- *Would leave* up to 40 percent of total U.S. gas production under federal controls indefinitely.

Partially controlled gas. Analysts warn that retaining price controls indefinitely on some natural gas could cause serious market inequities. For example, because rates charged by utilities for natural gas reflect their *average* cost of supplies:

- Some consumers, who are not supplied by utilities which have access to less expensive price-controlled gas, might have to pay a higher price for gas than others.
- Some regions of the country may lose natural gas supplies to others. In some areas, utilities which have access to artificially cheap, price-controlled natural gas could afford to pay higher prices for new, uncontrolled supplies and average their costs—while in oth-

er areas, utilities without this "cushion" could not.

Price disparity with oil. A further problem with the NGPA is that it sets price ceilings on gas that are unrealistically low. This is because the act's pricing formula does not take into account changes in world oil prices which have taken place since the 1979 Iranian revolution.

As a result, the highest price allowed for gas in December 1980, for example, was less than half the value of a comparable amount of oil (measured in Btus*). This pricing structure encourages less efficient use of gas than of fuels not subject to price controls—at a time when wise and efficient energy use is critical to the nation.

In sum, current U.S. natural gas regulation may create serious market inequities, while holding back critical new drilling and production and discouraging wise use of gas.

Decontrol of natural gas could, in contrast, further stimulate drilling for gas, encourage conservation, and as a result help the United States cut its dependence on foreign oil.

Federal Land Use Restrictions

The United States can also continue to adjust federal land use policy so that more energy is produced from America's own resources—and less purchased from OPEC oil fields.

Federal ownership. The federal government is the nation's largest landowner. It controls:

- About one-third of the land in the United States.
- All of the offshore area beyond state jurisdiction.

However, energy exploration and development are prohibited or severely restricted on about 60 percent of federal onshore lands—a total area nearly five times the size of California. Offshore, less than 5 percent of the Outer Continental Shelf has ever been leased.

Energy potential. Yet government lands are thought to hold a large portion of the remaining energy supplies of the United States. That is about 37 percent of our undiscovered oil, 43 percent of our undiscovered natural gas and 40 percent of our remaining coal.

Today, however, these lands provide only:

- 12 percent of U.S. oil production.
- 29 percent of natural gas production.
- 8 percent of coal production.

Sensible land use. America could benefit from sensible land use policies which allow us both to preserve and enjoy special scenic beauty and to gain needed supplies of energy and other resources.

In practice, this means that we can protect areas of special beauty but develop energy resources in other areas that have no unique scenic value. And even in these other areas, disturbances would be minimal and temporary. The land could be restored to natural conditions. Years of experience show that careful energy development can be compatible with natural preservation.

To help the nation move toward energy security while protecting the unique value of many federal lands, government can continue to move to:

- Permit timely, environmentally responsible access to government lands with the greatest potential for development of energy by competitive private companies.
- Coordinate overlapping responsibilities and resolve contradictory regulations of the many agencies that manage government lands.

*One Btu ("British thermal unit") is the amount of energy required to raise the temperature of one pound of water one degree Fahrenheit, at or near 39.2 degrees Fahrenheit.

Complex and Inflexible Environmental Laws and Regulations

More than a dozen major environmental laws were enacted in the 1970s. These laws—such as the Clean Air Act and the National Environmental Policy Act—have brought the United States closer to the goal of a cleaner environment. However, the complexity and rigidity of some of these laws and their accompanying regulations have, at the same time, unnecessarily restricted energy development.

Compatible Goals. Environmental goals and the nation's need to regain energy security are both important. The United States can achieve both, but not without a strong national effort. The problems:

- *Standards*—Some laws and regulations set pollution standards—often based on outdated studies—that go far beyond those necessary to protect the public. In some cases, permissible pollution levels are so low that they cannot even be monitored accurately with current field equipment.
- *Project approvals*—A maze of red tape, required permits and legal challenges has blocked or delayed energy projects of every kind. When all of the laws are added up, the number of permits required for a single project can easily run into the hundreds.

The result. These problems and delays mean the loss of energy production vital to the United States.

For example, careful changes in the Clean Air Act would add the equivalent of more than one million barrels a day of oil to energy production from three areas alone within the next 20 years—much of it within this decade.

Changes could add 350,000 barrels a day of heavy oil from the Kern County, California region; 400,000 barrels a day of shale oil from the Piceance Basin in Colorado; and 320,000 barrels a day of coal synthetics from several other areas. The total of these figures equals about 20 percent of mid-1981 U.S. oil imports.

These are not isolated instances. More energy production could be added to the U.S. total from many other projects that have been held up by complex laws and regulations. In 1981, before *any* energy project could move forward under the Clean Air Act, for example, it had to survive 37 specific "yes-or-no" decisions, and 24 chances by the federal government to slow down or stop the project altogether.

Sound policy. Sound U.S. environmental policy should include:

- Reasonable adjustments in standards to assure that they are based on the best current data available.

Millions of acres of federally owned lands hold vast energy potential, but laws and regulations block or slow exploration.

A natural gas processing plant is veiled by the wings of wild snow geese on the Louisiana Gulf coast near Avery Island.

- Simplified permitting processes.
- Realistic schedules and deadlines for meeting standards.
- Better coordination of federal, state and local regulation.

With these adjustments, America can realize important gains in energy production—and continue to pursue its environmental goals.

Nuclear Power: Delays and Uncertainties

In recent years, the nuclear power industry has been virtually paralyzed by uncertainty and delays. But sound policies in these areas can allow nuclear power to make its potential contribution to U.S. energy supplies during the 1980s:

- *Safety*—Government and industry can help resolve public uncertainty by rigorous monitoring of safety procedures and improved training of personnel.
- *Licensing*—Congress can simplify the procedures for obtaining new sites, construction permits and operating licenses.
- *Storage of spent fuel*—Government can resolve uncertainties about the storage of nuclear wastes by implementing a program for safe waste disposal.
- *Enrichment services*—Government must also proceed with plans to add to uranium enrichment capacity to assure necessary supplies of uranium concentrate for use in reactors.

Delays and uncertainties for nuclear power mean substantial loss to the nation of electric generating capacity—a loss which must effectively be replaced with other fuels, including oil imports. But timely and consistent government decisions on nuclear power will permit its orderly growth in the decade of the 1980s.

A Positive Atmosphere for Further Progress

As suggested earlier, the nation will progress more surely toward the goal of reducing U.S. dependence on imports during the 1980s if it takes full advantage of the inherently efficient operation of market forces. Deregulation of natural gas prices—if coupled with the removal of restrictions on natural gas use—would help allow all U.S. energy sources to compete freely in the American marketplace.

This would not only put conventional fuels such as oil, natural gas and coal on an equal footing, but also enhance the competitiveness of alternative energy sources such as solar, biomass and geothermal energy. As a result, the U.S. consumer could be assured the best possible choice of affordable, reliable energy supplies.

In addition, government can improve the atmosphere for future energy progress by safeguarding the flexibility and efficiency of the private sector as it seeks to find and develop new supplies of domestic energy. To the extent that special and arbitrary taxation of energy industries by federal, state or local governments limits that effort by private companies, future U.S. energy progress will be hampered. On the other hand, an economic atmosphere that permits the difficult and costly search for new energy supplies will assure future progress.

A nuclear power plant in Nebraska generates electricity for area consumers. Nuclear power can contribute significantly to America's future energy supplies.

Conclusion

Our recent progress has shown that Americans have a choice of energy futures. They need not accept the failures of the past. They may choose the hope of the future.

Today we see progress toward this better choice and brighter future. We can and must transform today's energy progress—and America's great energy potential—into the reality of that brighter energy future for all Americans.

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